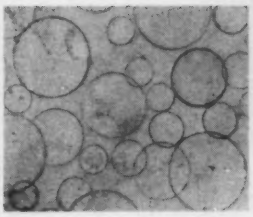


Effective and Easily Executed

FINISHES FOR CONCRETE SLABS

CONCRETE HAS LONG BEEN ESTABLISHED as the best material for driveways, sidewalks and patios. Other materials have had to compete on a cheaper-than-concrete basis. However, cheaper materials are sometimes used even when price is no object, just to get away from the somewhat stereotyped appearance of smooth troweled or brushed concrete.

For the last several years the garden and home magazines have included many feature articles on the new and unusual finishes for concrete. With millions of new home owners seeing all of these beautiful pictures of concrete in new and exciting finishes, the demand for this type of work is growing.

Facing constantly increasing competition for buyers, home builders realize that they must have something to attract the eye, something to set their homes above the competition, something different. One of the first things the prospect sees on approaching a new home is the walk, driveway or patio. Concrete here marks the home as a quality home, but a new and beautiful finish can help turn prospects into buyers.

To help homebuilders, concrete contractors, and cement finishers see how attractive these finishes can be and exactly how they are produced, the Portland Cement Association recently built a series of demonstration slabs and made a movie of the process. The site selected was their Laboratory at Skokie, Illinois. The finishes selected were exposed aggregate, a new flagstone method, dry-shake color, redwood divider strips, circle patterns, leaf impressions, and brush and float techniques.

The film will emphasize that proper placement of concrete is more than dumping concrete on the ground between boards and leveling it off. The first step in placing any slab is site preparation. All sod and debris must be removed, and soft spots drained and compacted. The most important points are to provide uniform support for the slab and to insure a uniform slab thickness. Where uniform support is not provided (for example, where part of the slab is on hard dense clay and the rest on soft top soil) uneven settlement and uneven movement caused by freezing and thawing will result in cracking.

Uneven concrete thickness will also result in non-uniform support, rocking of the slab and cracking. Even worse than gradual variations in thickness are abrupt changes caused by large rocks, pipes or stumps. Obstructions of this sort are far too frequently ignored in the belief that they are as hard as the concrete anyway or that they will never be seen again. They will be seen again—first as cracks and again when the slab is torn out and replaced. The best method of insuring uniform support is to excavate deeper than the bottom of the slab and then carefully backfill with well compacted sand or suitable granular material. This also simplifies obtaining a uniform slab thickness and provides good support on which to place the forms.

The need for care in setting forms and screeds is obvious for they determine the grade and shape of the finished slab. The small amount of time required to set intermediate screeds will pay off in eliminating bird-baths and humps. Forms that

are firmly supported from below will not go down when stepped on or run over by a loaded wheelbarrow. When the concrete arrives everyone is too busy to be concerned with the forms. For the finished slab to have the intended shape and grade the forms must be sturdy enough to withstand the activity of placing and finishing the concrete.

Placing the concrete is the same for all finishes —the basic rules always apply. The ground and forms should be wet down before the concrete is placed. There should be no puddles of water to weaken the concrete. The concrete should be placed as close to its final location as possible and moved as little as possible to keep the heavy aggregate from sinking to the bottom. The concrete should be struck off promptly and brought to the level set by the forms. The surface should be smoothed quickly with the darby to remove bumps and depressions and to embed the coarse aggregate. Then leave the surface alone. Concrete once struck off should be left undisturbed until ready for finishing. Any working of the surface while free water is present will mix that water into the concrete and weaken the surface. Most surface failures are caused by too early or too much floating and troweling.

exposed aggregate surfaces

The aggregate to be exposed must be carefully selected. The color and size depend on the effect desired. This is limited only by the availability of material and the imagination of the designer. However, the aggregate must be hard, sound, and of proper shape. Thin, flat pieces will not bond properly to the concrete and will be loosened and come out either while being exposed or soon after the slab is open to traffic.

The aggregate should be stock-piled in a convenient location to be available immediately after the concrete is screeded and darbied. It should be sprayed with water about the time the concrete arrives so that the surface of the stones will be damp when placed. As soon as a small area has been darbied the stones should be spread uniformly over the surface.

The entire area should be covered with a single layer of stones. The presence of stones on top of other stones will only increase the difficulty of embedding the aggregate. Special care should be taken to be sure the edges of the slab are well covered. Having the aggregate damp will help in embedding the particles in the concrete, but care should be taken that no excess water is carried to the concrete. As soon as an area has been covered evenly, the stones should be embedded completely in the surface. A patting action of rapid light taps with the darby will do best in this operation. This starts a flow of paste to the surface as the stones go down. A few light passes with a float will then return the surface to the same appearance it had following the first darbying. In very hot weather or on very large jobs it may be necessary to brush or spray a reliable retarder on the surface.

The time for exposing the aggregate is quite critical. It should be done as soon as the concrete has set sufficiently to hold the aggregate firmly, and while the paste can still be removed by light brushing and flooding with water. Ideally the surface paste should be removed with a hair brush and a full flow of water across the surface provided by a hose without nozzle laid on the surface. When setting is too rapid to permit this, a stiff fibre stable broom and a nozzle may be used, but care should be used to avoid dislodging the stones.

Brushing and washing should continue until the desired degree of exposure has been attained. However, care must be taken to assure that slightly more than one-half of the depth of the aggregate remains embedded. Where necessary a scrub brush and a pail of water can be used to clean up individual spots missed in the general wash. Approximately two to four hours after the aggregate has been exposed it should again be washed and very lightly brushed to remove any cloudy residue on the aggregate.

An alternate method is the wet-top or two-course method. This consists of a base course which is struck off approximately one inch below the finished surface and a topcoat containing the special aggregate in place of the coarse aggregate. The top course should not be placed until the base course has hardened sufficiently to be ready for troweling. Placing of the top course may even be delayed until the next day. If delayed till the following day, the base course should be hosed down thoroughly and scrubbed with a cement slurry before placing the top course. The aggregate in the top course is then exposed as described above.

Following the second washing the slab should be well cured by any of the accepted methods. Perhaps the best method for exposed aggregate is a 3- or 4-inch cover of thoroughly wet sand. The sections of concrete holding the individual pieces

of aggregate are quite thin; consequently they must be well cured to develop their full strength to prevent loss of stones from the surface.

Regardless of the method used, finishers who are not familiar with exposed aggregate work should make a sample panel before starting on any important job.

flagstone finish

Flagstone finishes made by tooling in artificial joints after troweling are familiar to everyone. They have one common fault: the uniform joints look mechanical. The method described below gives a very real looking flagstone joint. It also permits the finisher to see the pattern of his "stones" and to make such adjustments as he wishes before actually jointing the slab.

The joints are made by troweling in prepared wooden joints which are removed after the slab has hardened. Wood lattice stock ¼ inch by 1½ inches is cut into random lengths from 4 inches to 32 inches long. These pieces are then finished by carving the sides into irregular jagged shapes. The edges are undercut so that the bottom face will be narrower than the top face to prevent locking into the slab and permit easy removal. To prevent curling the pieces should be waterproofed by two complete coats of good varnish or thoroughly water soaked prior to use.

After the slab has been screeded and darbied it is allowed to set until ready for finishing. In this case it is necessary to begin finishing somewhat sooner than normal. The wooden joints are laid out on the slab in the desired pattern.

The strips can readily be adjusted to improve the pattern by simplifying complex shapes or eliminating flags that are too small. As soon as the pattern is adjusted the wooden strips are pressed into the concrete and the surface is floated. Care should be taken to bring the top of the wood just flush with the top of the concrete. The concrete can then be troweled for a normal gray color, or a dry-shake color can be added at this time.

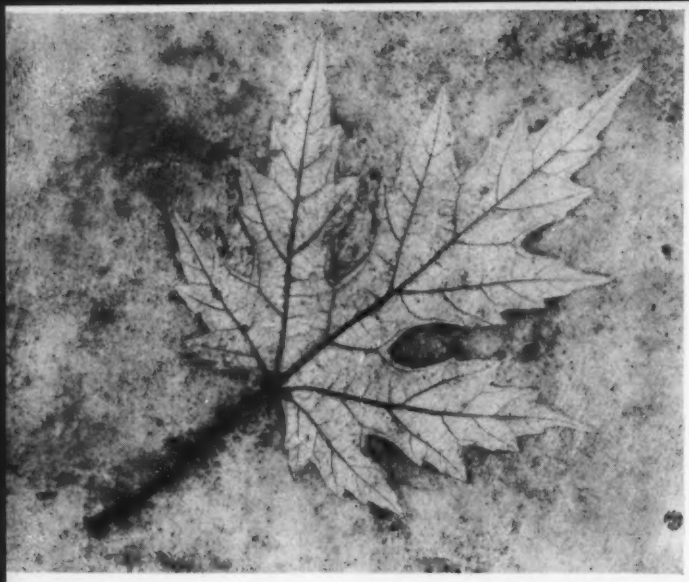
To insure a uniform color it is best to use a factory prepared color topping. Color toppings consist of portland cement and fine aggregate in about equal parts plus the required pure mineral oxide pigment to produce the desired color. This pigment is a very fine powder and it is practically impossible to job-mix the color without getting color streaks and variations.

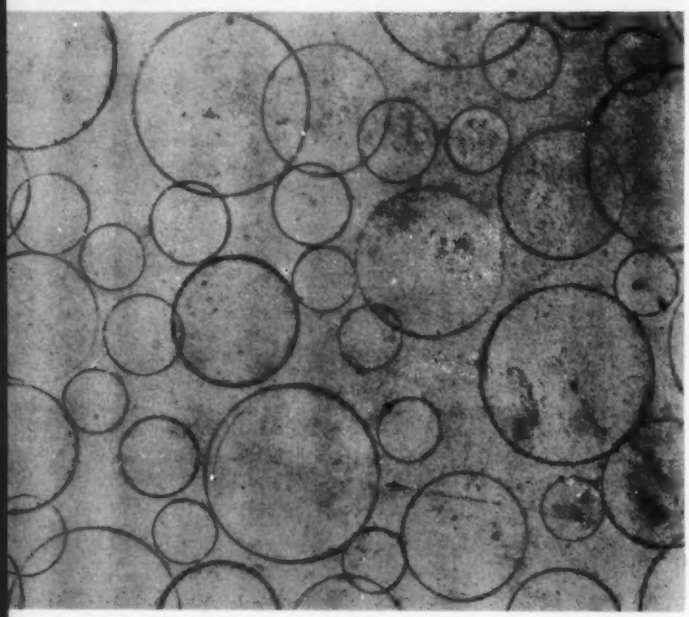
The dry-shake color is thrown over the surface with a swinging shaking motion of the arm and the powder is released between the spread fingers to break it up and produce a uniform distribution. It is best to spread about half the required amount. This is floated and troweled before adding the other half. After floating the second application, and before troweling, the tops of the wood strips

Photo above shows the prying up of one of the prepared wooden joints used to produce a simulated flagstone finish. The slab can be left depressed as shown below, or the joints can be filled with a contrasting mortar.

should be cleaned of paste which may have been carried over them. A patching trowel or putty knife can be used to scrape the wood clean. The final steel troweling will then bring the wood joints and concrete to a uniform surface which can be left smooth, or lightly brushed. The following day the curing cover can be taken off and the wooden strips removed by lifting with a patching trowel. The slab can be left with depressed joints, or the joints can be filled with a contrasting mortar. A natural gray slab with white mortar joints is very attractive. Natural gray joints look well with a colored slab.

Before filling the joints the slab should be flooded with water to keep it cool and keep the joints damp. Immediately before troweling in the mortar the joint should be brushed with a paste of portland cement mixed to a heavy cream consistency with water. Care must be taken to prevent smearing mortar outside the joint area. A large, coarse synthetic sponge and bucket of water will be useful in cleaning the joint edges. In this operation it is best for two finishers to work together. One should paint in the cement grout ahead of the mortar and clean up the joint edges while the other concentrates on packing in the mortar firmly and neatly. (MORE)





applied designs

Many designs can be readily imprinted in the surface of concrete. One of the most interesting is leaf impressions which give the effect of age-old fossils. Large fresh perfect leaves should be selected and picked at the last possible moment before using. Immediately after an area has been given its final troweling and/or brushing, the leaves are placed on the slab where imprints are desired. This could be either in a regular border around the slabs or in random clusters. After the leaves are located, the finisher presses them into the surface with a steel trowel. Care must be taken to prevent cutting or tearing the leaves with the trowel edge. A small amount of paste may be carried over the top of the leaf but this should be held to the minimum consistent with completely embedding the leaf. For the best results the leaves should be left in place until the slab is cured when they can easily be removed by pulling on the stem.

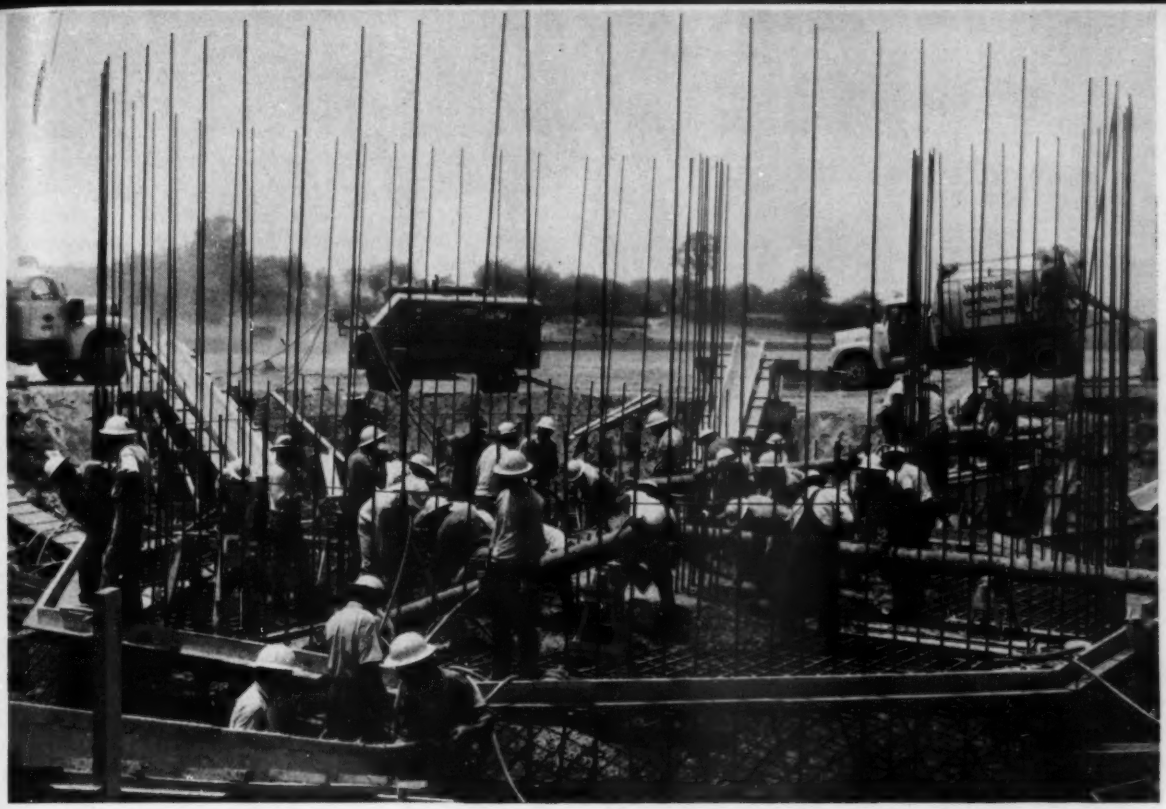
A second pattern can be made by marking circles on the slab after the final smooth finish has been completed. This can be done with a variety of sizes of tin cans in random pattern or by one or more sizes in a definite regular pattern. Large metal cookie cutters in various shapes can also be used for this purpose.

Where a large area is to be finished in this fashion, more workmen will be required. Immediately after the final troweling the surface will be quite hard, but can still be easily marked. However, as the slab continues to harden it will become more difficult and finally impossible to make impressions to the same depth and appearance. When more than one workman is doing this job, their work must be carefully coordinated so that the finished pattern will be uniform. A good method for agreeing on the design to be used is to produce a sample pattern on a nearby driveway or sidewalk by dipping the tools in powdered chalk and marking an area large enough to serve as a guide. This can be washed away later. A large sheet of primed wall board can also be used.

textured finishes

The texture of the finish can be varied as desired from very smooth and slick to as rough as a frozen gravel path. The smoothest finish of course is produced by a highly skilled workman using a steel trowel, with the final troweling being done when the surface is very hard. A softer finish can be made by starting the final troweling sooner and by finishing with a swirling motion of the steel trowel held flat like a float. This produces a matt finish. The surface can be further varied by advancing the time of the final finishing operation and by varying the tools used. Aluminum and magnesium floats will produce medium textures while wood and cork floats will produce coarser textures. Brushes and brooms too will produce a wide variety of textures. A soft hairbrush drawn across a hard troweled surface will only take the gloss off the finish, while a stiff fibre bristled stable broom on soft concrete produces a heavily textured nonslip barnyard surface. The pattern of floating or brushing too can be varied, from tight twists with the float to wide sweeping arcs or figure eights and from straight parallel passes with the brush to wavy strokes or combinations of the two.

Infinite variations of finish are possible for concrete surfaces, limited only by the imagination of the designer and the skill of the craftsman. Many of these finishes can be produced with no more effort and expense than standard finishes, and in some cases the cost may be even less. They all add new beauty and appeal and help sell more concrete. **END**



The partnership of concrete and steel is dramatically typified by this construction site photo showing crews placing concrete on and within a labyrinth of reinforcing bars.

THE DEVELOPMENT OF REINFORCED CONCRETE

THE ART AND SCIENCE of concrete construction has a long history, dating at least to ancient Rome. The development of reinforced concrete, on the other hand, is relatively recent, being scarcely one hundred years old. Numerous men and organizations in Europe and the United States have made major contributions to the understanding and use of reinforced concrete, and our purpose here will be to provide a quick review of some of the high spots.

Jean Monier, a French gardener who knew nothing about engineering or architecture, has long been given credit for the first use of reinforced concrete. Monier embedded wire nets in concrete to produce strong and durable tree and flower pots, and patented his process in 1867. Later, in the 1870's, Monier obtained patents on processes for building reinforced concrete pipes, reservoirs, floors, straight and arched beams, and bridges.

However, thirteen years before Monier's initial accomplishment, W. B. Wilkinson in England developed a form of reinforced concrete for fire resistant floors, reinforcing his material with wire ropes. In France, Francois Coignet in 1865 received a patent for a process of constructing floors reinforced with longitudinal and transverse rods embedded in concrete. In the United States, R. B. Stevenson in the 1850's patented a method of using

These two photos of the Pantheon in Rome, an outstanding example of the lasting qualities of concrete even without steel reinforcement. Built in 117 to 138 A.D., the roofs and arches of the 140-foot diameter dome are of concrete.

mortar and sheet metal to cast concrete pipes. And, also in this country, S. T. Fowler in 1860 introduced a method of embedding horizontal and vertical timbers to reinforce concrete walls.

Jean Monier did not invent reinforced concrete, but he did much to popularize it. In a comparatively short time, aided by trained engineers, he constructed nearly a thousand reinforced concrete water and gas tanks in France.

During the developmental period of reinforced concrete construction, numerous men introduced systems, most of them under patent for the exclusive benefit of their developers and promoters. One of the most successful systems was that perfected by Francois Hennebique in France, who developed a method of using two series of reinforcing rods. One of the series was straight, and lay in the lower part of the concrete. The other lay on the top and bent down near the center of the span to lie close to the straight rods. Hennebique also used flat iron stirrups in beams and slabs. His method, at the same time, called for the casting of slab, beams, and columns as a single unit, and thus he has received credit for originating monolithic construction. With modifications, several features of the Hennebique system remain in use today. Between 1892 and 1899, Hennebique and the contractors licensed to use his system completed hundreds of reinforced concrete buildings.

Thaddeus Hyatt stands out among the pioneers of reinforced concrete in the United States. Although Hyatt apparently built little himself, he was a careful and tireless experimenter and added much to the knowledge of reinforcement.

Searching for fire-resistant materials in the 1870's, Hyatt experimented with rolled steel girders and joints encased in concrete. He subjected beams and slabs to furnace heat to determine the time required for heat to penetrate layers of concrete, thus obtaining data for a thermal chart. He also experimented to compare the factors of expansion and contraction of concrete and iron, and demonstrated that reinforced concrete beams were free from danger of rupture by fire because the expansion of iron and concrete were the same. This discovery alone placed Hyatt in the front rank as a contributor to modern reinforced concrete design.

In other experiments Hyatt dispensed with floor joists and substituted flat tie-irons, proving that concrete would act as the compressive member of a beam or a slab while the reinforcement resisted the tensile stresses. Hyatt constructed concrete beams with tension iron in various forms. In some cases he used circular bars on the tops and bottoms of beams. In other cases he utilized bent bars for bottom reinforcement. Hyatt proved by experiment the existence of sound bond between iron and concrete and showed that the failure of different beams varies with respect to the amount of reinforcement.

Apparently without reference to Hyatt's work, William E. Ward, a mechanical engineer, became another United States pioneer in reinforced concrete construction. Ward earned his place indirectly because of his wife's great fear of fire.

To quiet his wife's apprehensions, Ward wanted

to build a fireproof home, and this objective led him to experiment with reinforced concrete early in the 1870's. He made careful tests of the deflection, shear strength, and fire resistance of reinforced concrete, and eventually reached the significant conclusion that iron placed near the bottom of a beam would utilize fully its tensile strength to resist strain below the neutral axis.

Completing his experiments, Ward engaged Robert Mook, a New York architect, to design the first reinforced concrete house in the country. The house was finished in 1875. All beams, floors, and roofs, as well as the external and internal walls, cornices, and towers were built of concrete reinforced with light iron beams and rods. The only wood in the building was in the window frames, doors, and stair railings.

Ward's neighbors at Port Chester, New York, where the house stood, reacted normally. They expected the imminent collapse of a building constructed of such unorthodox materials, and said as much, calling the house "Ward's Folly." But after the house proved itself comfortable and durable, it became "Ward's Castle."

Probably no one man did more to popularize reinforced concrete building in the United States than Ernest L. Ransome, son of Frederick Ransome, who developed one of the first rotary kilns for manufacturing cement in England. Ernest L. Ransome became superintendent of the Pacific Stone Company of San Francisco in 1870, and soon thereafter grew interested in reinforced concrete construction.

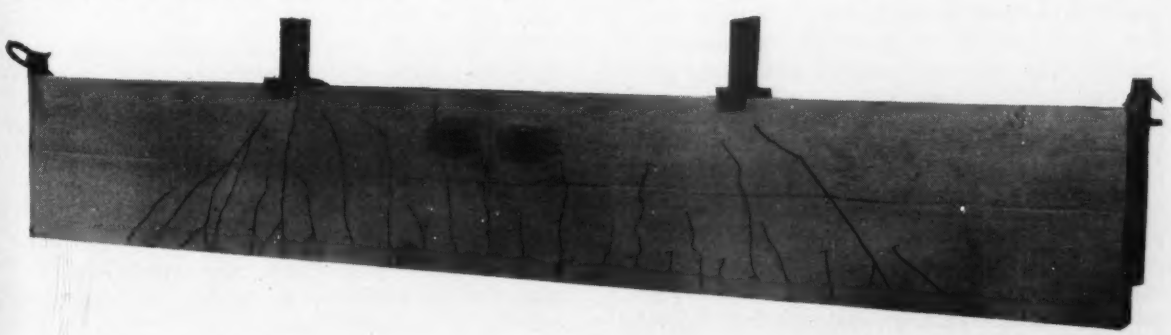
Ransome's first important use of reinforced concrete was in the construction of the Junior Museum at Stanford University in 1889-91. Ransome built the walls and floor of concrete and the roof of interlocking concrete tiles on iron trusses. The following year he erected a borax factory in Alameda, California, and in 1897 he invaded the east coast to build a similar structure in Bayonne, New Jersey. Before the twentieth century was more than a few years old, Ransome had reinforced concrete buildings of various types to his credit in New York, Illinois, Connecticut, Ohio, and Washington, D. C. One of his important contributions to reinforced concrete design was the development of a basic structure consisting of a series of columns and floors between which the concrete walls could be cast in place as desired. This design eventually replaced the common practice of erecting concrete walls that were load bearing and hence thick.

The development of reinforced concrete was not confined to its use in buildings, of course. Toward the end of the nineteenth century Edward Thatcher in the United States and Fritz von Emperger in Austria-Hungary made contributions to the development of reinforced concrete bridges. Other men, such as Burnham in Chicago, furthered the use of reinforcement in concrete foundations. Chimneys, crib work, piers, railroad beds, grandstands, tanks, and sewers were also constructed of reinforced concrete.

By 1900 various names were applied to reinforced concrete. It was called armed or armored concrete, ferro-concrete, hooped concrete, sidero-concrete, steel concrete and concrete steel. Regardless of the term, architects, builders, and the general public viewed the material with mixed emotions. Disastrous fires pointed up the value of buildings constructed of reinforced concrete, but the widely publicized failure of some concrete buildings in the United States raised serious doubts about the material. Many difficulties resulted from too early removal of forms, careless and unwise placement of reinforcement, inadequate provision for expansion and contraction due to temperature change, weak or leaky forms, inadequate tamping, and excessive dependence on empirical designs and fallacious load tests.

Much of the experimentation and use of rein-

The function of reinforcing steel in a concrete beam is graphically indicated by the pattern of cracks in this laboratory specimen after it was loaded to the verge of failure. The tensile stresses in the bottom portion of the beam were transferred to the reinforcing when the concrete cracked.



Another interesting example of the staying power of concrete is this remarkably well preserved section of the first stone and concrete aqueduct built in the United States. The structure was completed in 1769 to carry water to the Mission of San Diego, California.

forced concrete had been on a trial and error basis. Ransome had experimented more extensively than most, but he had developed no underlying theory to govern any part of reinforced concrete construction. Mathias Koenen, in Berlin, Germany, was the first experimenter to deduce methods of computation for load tests, publishing his analysis of tests conducted in Germany in 1886. Koenen based his theory of flexure on the following premises: (1) plane sections perpendicular to the neutral axis prior to bending remain so following bending; (2) stress is proportional to strain; (3) there is perfect bond between concrete and steel; and (4) tension stresses in the concrete are not considered. Koenen's basic procedure is still generally accepted and used today.

With this beginning in theory, some basis existed for the development of standardized procedures for design, construction and testing of concrete. Within the first decade of the twentieth century such standards were established in Germany, France, England and Switzerland. In the United States, during 1903 and 1904, the American Society for Testing Materials, the American Railway Engineering and Maintenance of Way Association, the American Society of Civil Engineers, and the Association of Portland Cement Manufacturers (which later became the Portland Cement Association), appointed committees that agreed to investigate jointly problems connected with reinforced concrete. The Joint Committee's objective was to investigate current practices and provide information on the properties of concrete and reinforced concrete. It was also to recommend necessary factors and formulas required in the design of structures using these materials. The Committee, along with several universities investigating reinforced concrete, looked into such problems as complex flexure beam tests, shearing strength of plain and reinforced concrete, strength of T beams, temperature changes and their effects, the effect of position and shape of reinforcing bars for various steel percentages, loading effects, bonds, methods of bending up reinforcing bars, and diagonal tension cracks. The Joint Committee published several progress reports, and its final report appeared in 1917.

The American Concrete Institute also became an influential organization in the development of reinforced concrete standards. Chartered in 1906 as the National Association of Cement Users, it changed its name to ACI in 1913. The ACI had affiliated with the Joint Committee before the Committee's final report, and devoted additional attention through committees of its own to the study of reinforced concrete and to procedures for its use. The Joint Committee published subsequent reports in the 1920's, and submitted the last one in 1940. The ACI continued its work on reinforced concrete after that date, revising its code of practice in 1941, 1947, and 1951. During the 1950's the ACI gave particular attention to the study of precast and prestressed reinforced concrete.

The history of reinforced concrete shows that numerous individuals worked to improve construction methods and design, often without communication and coordination with one another. To win full public and professional acceptance of reinforced construction, the need for scientific investigation and standardization arose. The Joint Committee and the ACI filled this need, and commenced research soon after the turn of the century that has benefited the industry immeasurably and which continues today. END

Prestressed Pylons and Cables Support This School Roof

AN IMAGINATIVE DESIGN CONCEPT by an architect has produced the West Coast's first all-concrete structure wholly supported by cables, providing a new type gymnasium and field house with a completely column free interior, lowered heating costs and easier and more economical maintenance.

The $1,440,000 project for Central Washington College at Ellensburg was built for $14.15 per square foot. It provides a clear floor area measuring 150 by 390 feet with a 35-foot minimum height. Galvanized bridge cables held aloft by concrete pylons support the entire roof except where it is fastened to the exterior walls.

The selection of a cable suspended roof system on pre-stressed concrete pylons was based on a number of considerations, many of them applicable to building construction everywhere. By reversing the more conventional trend and dramatically revealing the structure on the exterior of the building the designer achieved an interesting alternative to the "big barn" appearance which normally results when so much net space must be enclosed. This decision, of course, also eliminated extra high exterior walls as well as any need for heating and lighting of the 40 percent additional space which would have resulted from the use of truss or arch designs. Total wall height was reduced about 14 feet. The design also encouraged the use of controlled daylight through the installation of skylights and a system of automatic louvers controlled by photoelectric cells which close or open in response to the amount of light falling on the roof.

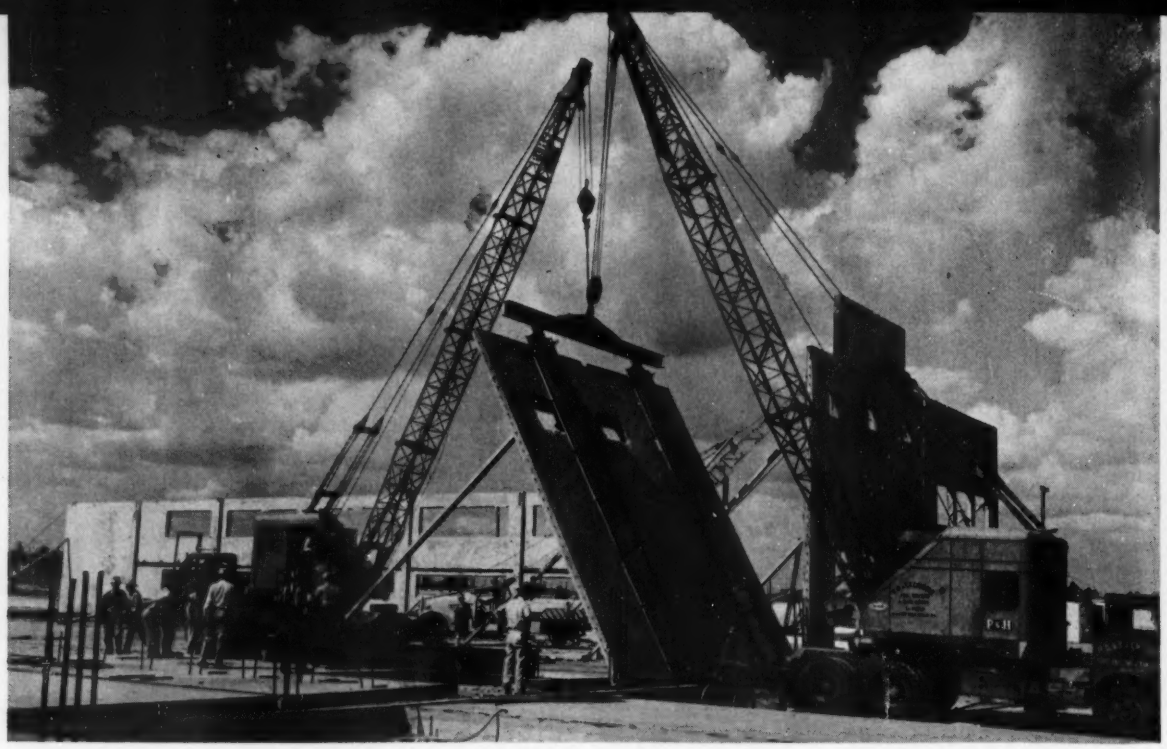
The school structure features a series of 78-foot high pylons which grasp the steel bridge strands supporting the floating roof. The ends of the strands are anchored in continuous concrete dead men buried 12 feet below the surface. The cables are galvanized bridge strand 1⅜ inches in diameter.

The post-tensioned concrete pylons are free-standing and carry extremely heavy loads. The units are hollow with 4-inch thick walls, and they were made of 7,500 psi concrete. Half-inch lead plates under the bottom of each pylon equalize the pressure on the concrete.

The walls of the building are of tilt-up construction using 30-foot square panels of lightweight concrete surfaced with pink crushed marble to eliminate painting and maintenance. Columns between the panels were also precast on the site; they are welded to the panels and sealed with provision for expansion and contraction.

The architect on the project was Ralph Burkhard and the contractor was Anderson, Birkeland & Anderson of Tacoma. END

FILE: Roofs



Some Characteristics of

TILT-UP CONSTRUCTION

TILT-UP CONSTRUCTION utilizes concrete in its hardened form rather than in its plastic form. It involves the casting of wall panels, usually at the job site, and their erection by a crane or other means to a vertical position for attachment to a floor slab. Tilt-up is well suited to one-story structures—warehouses, industrial, commercial and business buildings, and schools—and it has proved successful in some types of multistoried buildings.

Although the possibilities of tilt-up construction were realized as early as 1910, the method saw little use in the United States until about 1945. Since then, it has enjoyed increasing popularity. It is the purpose of this article to deal generally with some of the principles, procedures, and problems that characterize the method.

The advantages of tilt-up construction are numerous. Important among them are: (1) the formwork for the wall panels is cut to a minimum as only perimeter forms are needed; (2) production line techniques are readily applicable to most phases of the work; (3) reinforcement, electrical conduits, and window and door frames are easily placed in open, horizontal forms; and (4) a wide range of architectural designs and treatments may be included with little loss in economy.

Two types of wall panels lend themselves to tilt-up construction—the thin shell and the flat cast. Thin shell panels are usually cast in especially fabricated molds, often at a factory, occasionally at the job site. These panels are economical in materials, relatively light, and easily stored. However, they require higher strength concrete than flat cast panels and the forms are often uneconomical to fabricate unless utilized at least 30 to 40 times.

Flat cast panels, the more common type in tilt-up construction in the United States, require more material, are heavier, and involve greater deflection and plastic flow than thin shell. But flat cast forming costs are small, the job site can be easily used for casting, less quality control is demanded throughout, and common and unskilled labor can be used to advantage.

Flat cast wall panels prepared on the job may be cast on the earth, on a bed of sand covered with a polyethylene sheet, or on a thin concrete skin. However, with few exceptions, the floor slab itself is the ideal casting platform. Under certain conditions panels may be cast in stacks, using plywood or polyethylene sheets between the units.

FILE: Tilt-up

Regardless of the type of building in which they are used, concrete floor slabs must be level, smooth, and tight, free from unsightly cracks, and strong enough to bear storage and traffic loads. In tilt-up construction, since the slabs usually serve as casting platforms, they must be especially free from cracks, for any cracks will be cast in reverse in the wall panels. While this in no way affects the strength of the panels, it often affects the customer's satisfaction with the job. Since in many cases the floor slab will serve as the wall erection platform, and therefore must bear the weight of heavy erection equipment, the strength of the slab assumes paramount importance.

In part the slab's strength depends on the subgrade. A poor subgrade will allow floor bending and cracking during wall erection. Hence the builder must know something about the soil on which he works, and compact it properly before casting the slab.

As to reinforcement, some authorities believe it unnecessary in the floor slab, asserting that customers would be better served by an extra inch of concrete. Other experts disagree. Reinforcement does control the size of cracks and spaces them closely together, but effective concrete crack control also depends on familiarity with and allowance for the material's shrinkage while it is subjected to temperature variation during hardening. The tendency of slabs to crack can be curbed by placing an inch of sand beneath the concrete, as well as by the proper use of large aggregates, air entrainment and crack control joints.

A building's purpose will in some measure determine the desirable thickness of the floor slab. The slab may range from 4 inches for office buildings to 8 inches for heavy duty storage buildings. Concrete for the slab should have a minimum 28-day strength of 3,000 psi, but for maximum resistance to abrasion during wall erection a strength of 3,500 to 3,800 psi is recommended. Experience indicates that concrete with a slump of 2½ to 3 inches, with aggregate of at least 1½ to 2 inches, works well. Ponding or wet curing of the concrete gives best results; spraying and fogging with water, then covering with waterproof paper the next best.

Footings for the wall panels may be prepared as the floor slab undergoes finishing. A good procedure is to trim the soil along the edges of the slab to as near the vertical as possible, drill the footings by machine (interior footings, too, if needed), and immediately line with concrete. The openings should be covered with plastic film blankets to keep water out.

Wall panels for tilt-up construction are usually 6 to 8 inches thick. Aggregate should be at least 1½ inches and may be as large as 2 to 3 inches. The standard practice is to use 5 sacks of cement per cubic yard to obtain a 28-day strength of 2,500 psi. Lightweight concrete composed of expanded slag or shale aggregate may be used for wall panels, but it should be noted that lightweight costs more than conventional concrete.

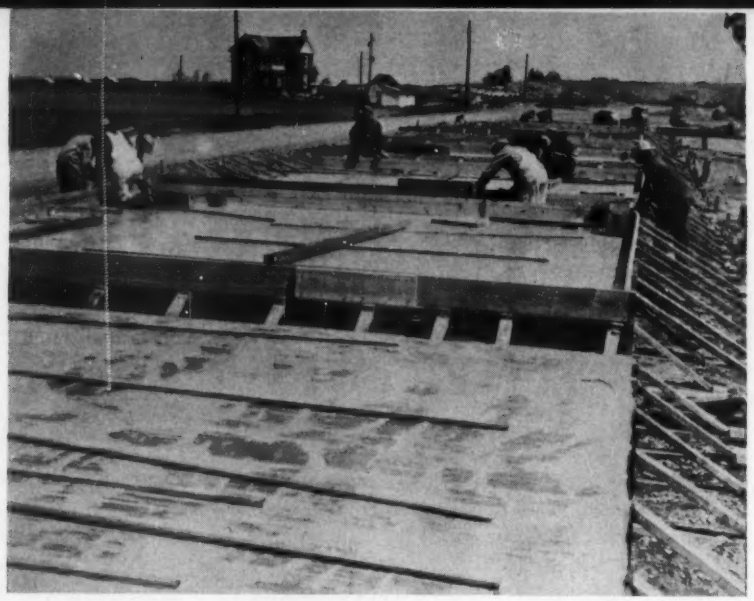
Stopping pipes and utilities below the surface and temporarily closing the openings with a sand filling and a thin coat of mortar are part of the planning for panel casting when the floor slab is used. In addition panel form layout should be planned with an eye to the most economical use of available space.

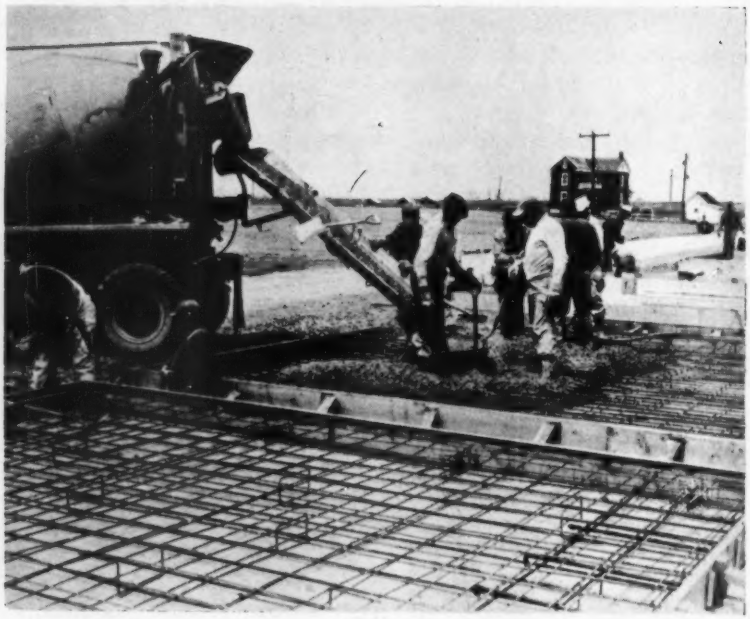
Builders have employed oil, grease, canvas, polyethylene film, paper and plywood as bond breakers between floor slab and wall panels. There are numerous liquid bond breaking materials on the market that are efficient, low in cost, and easily brushed or sprayed on the slab. These materials serve a dual role as bond breakers and as curing membranes. The recommended procedure with liquid bond breakers is to spray an even first coat on the slab, and on the following day to lay the panel forms and apply a second coat of the same or lighter consistency. Spraying the forms at the same time will seal them from moisture and facilitate their removal.

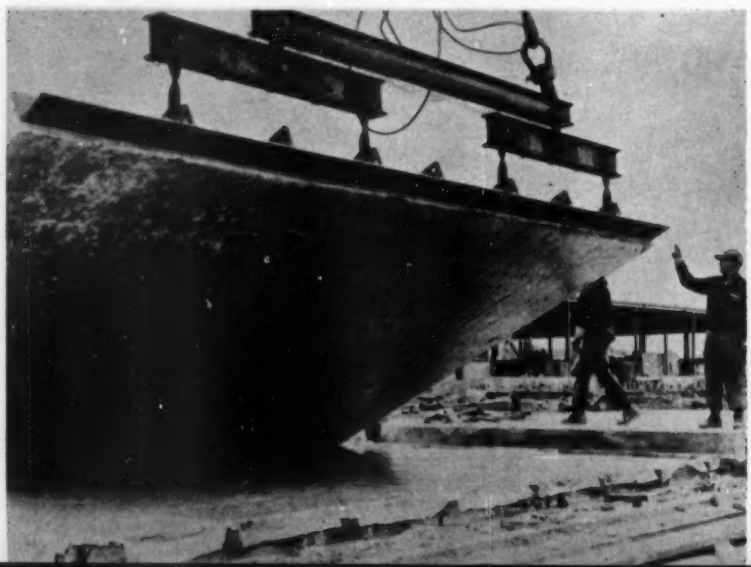
Since wall panels are subject to considerable stress during erection, there is little question regarding the desirability of reinforcing them. To speed this operation, some builders have found it expedient to prepare the reinforcement outside the panel forms while the floor slab undergoes finishing. A jig can be set up to space the steel for identical mats, and the bars can be tack welded or tied. When all is ready, the mats can be lifted and set into the panel forms. The ½-inch round bar is generally used for reinforcement, although some builders prefer ⅜-inch or even ⅝-inch steel. Some builders extend all horizontal bars for the wall panels as dowels into poured columns at joints; others stop the bars at the panel edges and use lapping dowels. The generally accepted rule falls between the extremes: extending 50 percent of the bars as dowels.

Cracking wall panels during erection is detrimental both to structure and to sales. Consequently some authorities favor prestressing over conventional reinforcing. Reinforcing steel in most concrete structures can be placed so as to absorb tensile stresses. Tilt-up wall panels are relatively thin, and the reinforcement must usually be placed at the neutral axis rather than on the tension side. As a result bending stresses during erection rest largely on the concrete. The steel does not go to work until the concrete cracks. Tensioning the steel by prestressing, some experts assert, will increase compression and the modulus of rupture and thus diminish the chance of cracking the panels.

In planning wall panels provision must be made for pickup





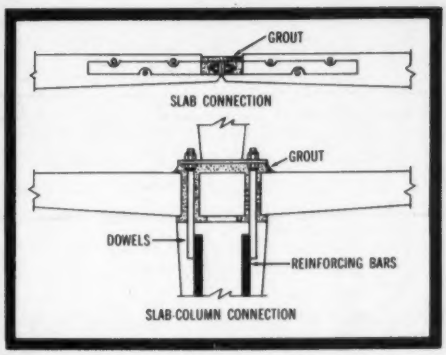


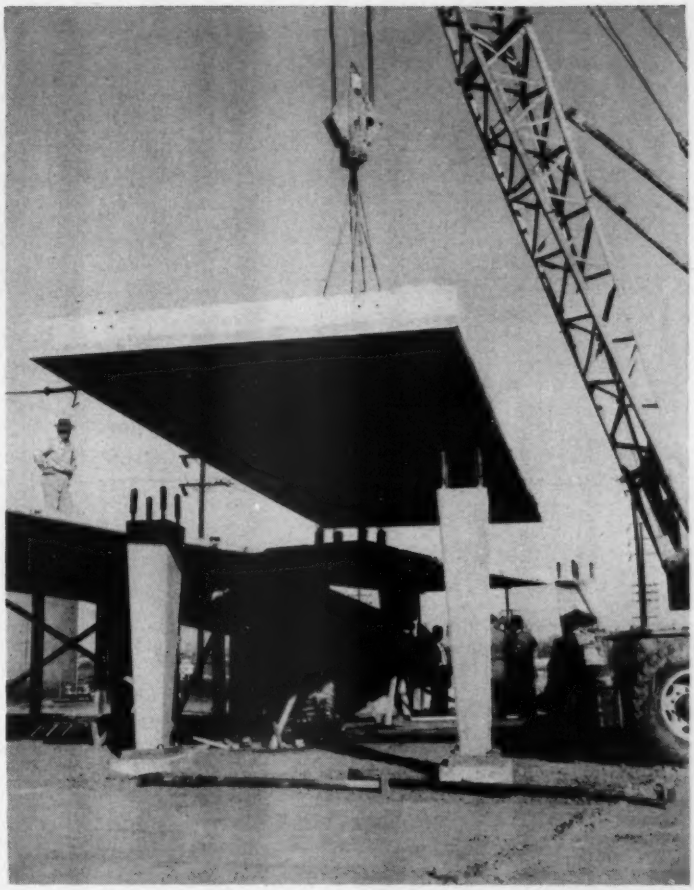
This picture sequence shows just how simple the whole idea of tilt-up is. As shown in the top view, wall panels are formed right on the floor slab. Bond between the two surfaces is prevented by use of a separating compound or polyethylene film. When panel has developed required strength, it is tilted into position by means of a crane.

insert eyebolts, brackets, or hairpin units, which are generally welded to the reinforcement and the protruding parts removed as the building is finished. These units may be purchased or fabricated by the builder. It is possible, by providing for proper holes in the panels, to use recoverable pickup units consisting of a sleeve and plate to which an insert is attached by a bolt. They can be removed and the holes filled upon the completion of panel erection.

The size and shape of the panels will to a great extent determine the number and placement of pickup points. A 2-point pickup suffices for many panels, but for larger ones 4- and 6-point pickups have been utilized to allow properly for stresses. Vacuum lifting devices that eliminate special inserts have been developed. Their major use appears now to be with thin shell panels; for large, flat-cast panels, the point pickup system is at present the most economical.

Placing and finishing concrete for wall panels is much the same as for floor slabs. Usually concrete is placed in the forms directly from the ready mix truck, although some builders prefer to use a crane and bucket. Space problems may dictate this procedure. Vibratory screeds are generally not suitable for wall panel finishing, as the surfaces are small and there are numerous projections. At the same time, because panels are cast on a sealed surface, there can be no downward movement of water in the concrete. The upward movement of all water causes formation of tiny channels which produce





PHOTOS THROUGH COURTESY OF TISHMAN RESEARCH CORPORATION, NEW YORK, N. Y., DESIGNERS AND DEVELOPERS OF TIERPARK GARAGES

5000 psi in sixteen hours with SIKA SET

Grout and dry pack mortar with rapid strength development and minimal shrinkage is essential for the fast erection of the new Tierpark Parking Structures developed by Tishman Research Corporation. Composed of only three elements — slabs, columns and ramps — a Tierpark structure is erected within a matter of days.

Mix proportions for high strength grout and dry pack mortar were developed at the Sika Concrete Laboratory. Sika Set liquid, diluted 1:3, added to the dry pack produced compressive strengths exceeding 5000 psi at sixteen hours. Sika Set, diluted 1:4, added to the poured grout produced compressive strengths exceeding 3000 psi at sixteen hours. Proportions of 1 part Type III cement to 1-1/2 parts sand were used.

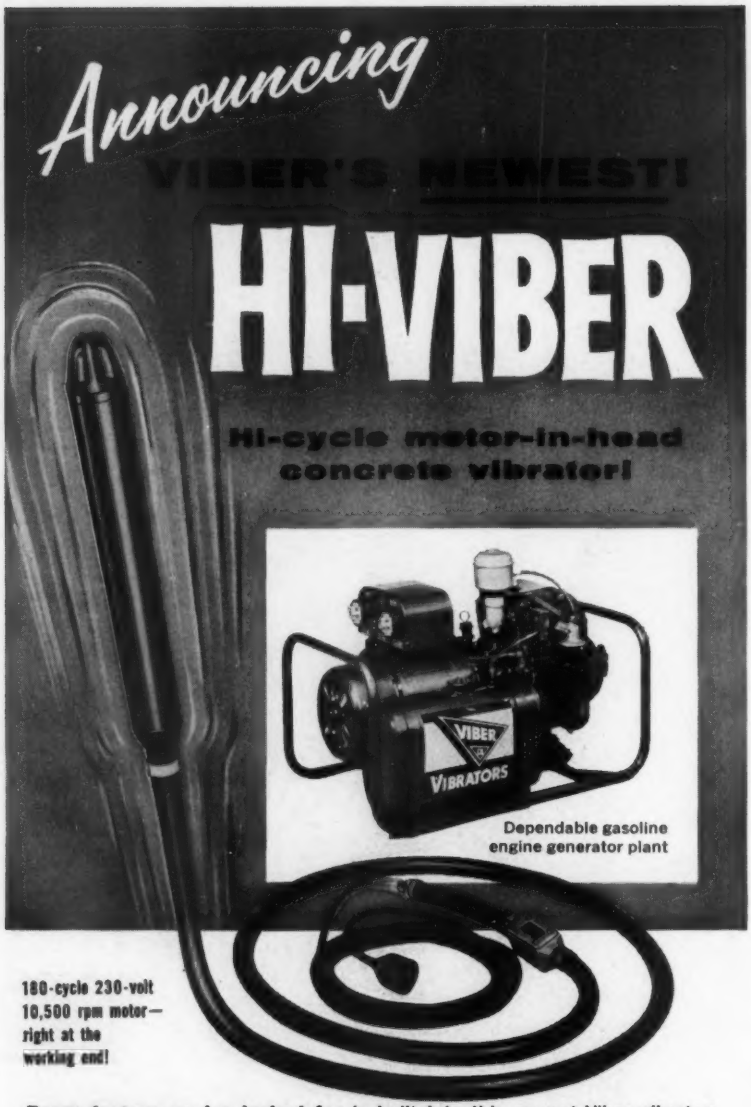
Structural concrete was initially retarded by the use of Plastiment Retarding Densifier to facilitate finishing — with rapid strength gain as an added bonus to the manufacturer of the precast, prestressed elements.

For full details on Sika Set Shrinkage Reducing Accelerator and Plastiment Retarding Densifier ask for your copies of SET-661 and PCD-59. Offices and dealers in principal cities, sixteen affiliate manufacturing companies around the world. In Canada, Sika Chemical of Canada, Ltd.; in Latin America, Sika Panama, S. A.

Sika

SIKA CHEMICAL CORPORATION

Passaic, N. J.



Every feature you've looked for is built into this newest Viber vibrator: brute power, high speed, one-man operation, easy maintenance. Hi-Viber consolidates the lowest slump concrete—with power to spare! It's easy to handle on narrow scaffolds, high forms or at hard-to-reach pour sites—as far as 200 feet from the generator. Simple motor design eliminates down-time and job failure. Just two moving parts—the rotor and the massive eccentric weight—turn on lifetime-lubricated sealed bearings. 1¾ or 2¾-inch diameter vibrator heads have interchangeable rubber or steel tips. For complete details, call your Viber distributor or write the Viber Company, 726 South Flower Street, Burbank 74, California.

VIBER LINE: Concrete Vibrators, electric, pneumatic and gasoline engine powered • Hi-cycle, Motor-in-head vibrators • Small diameter internal vibrators (electric or gasoline) • Laboratory electric internal • Mass concrete vibrators (pneumatic) • External vibrators (electric and pneumatic) • Full depth concrete paving vibrators

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plastic cracks, and vibration aggravates this tendency. As soon as the concrete will support weight, finishers must close these cracks.

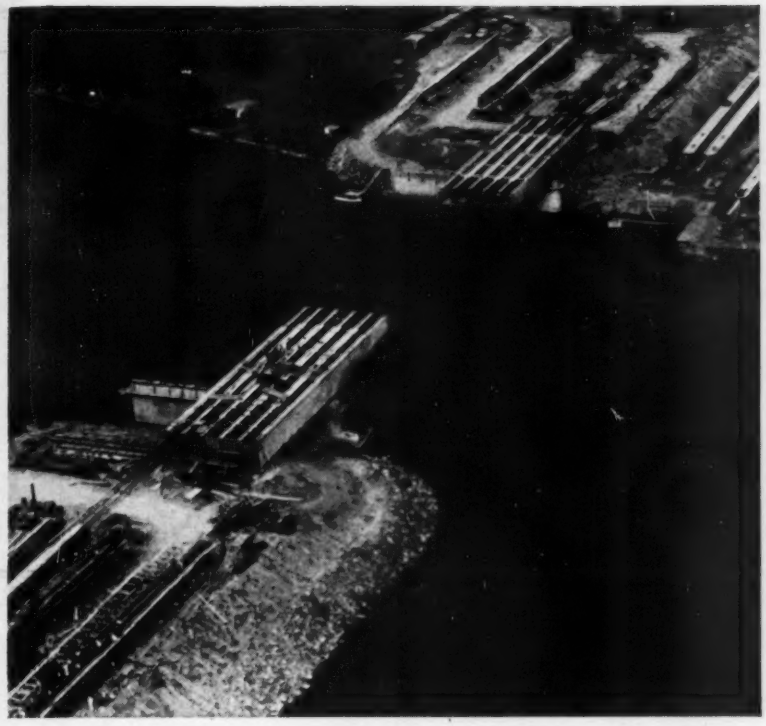
Steel sash cast on the inside face of the wall panels will provide insurance against cracks that might occur at window corners during erection. This steel sash can rest on the bucks, and the wooden frames should be shellacked or back-primed to avoid water absorption. A 45-degree saw cut is then made at each corner and the buck cleated to keep the cut open. When the concrete begins to set, the cleat can be removed and the buck allowed to shrink and close the cut, releasing pressure on the re-entrant angle of the concrete.

Once the wall panels are finished and properly cured, a critical stage of the building schedule begins, for the process of lifting the panels to a vertical position places them in some jeopardy. Here the destruction of one unit can disrupt the schedule, resulting in additional costs through lost time and replacement. Erection demands thorough planning, proper equipment, sound methods and properly trained personnel.

Truck cranes are the most common means for erecting wall panels, particularly panels for large buildings. Other means include lifting masts, truck or ground mounted A-frames, special leverage devices mounted on wheels, fixed cranes with booms, and telescoping hydraulic jacks.

In some cases a crane placed outside the building does the lifting. This is true for the erection of lower deck panels and the erection of panels for multi-storied buildings. With many single story buildings, where the floor is designed to take heavy loads and the panels can be cast face down, a heavy duty truck crane of at least 35 tons capacity is placed inside the building for the lifting operation.

Erection on the hinge principle does not work well with heavy, large panels, mainly because as



24 CANTILEVER GIRDERS, 147′ long and weighing 250 tons each, are hung from diaphragms set on bearings; none of the girders is supported directly from beneath. The 10 drop-in girders for the suspended span, each 231′ long and weighing 222 tons, were set between the cantilever girders and held by stressing rods passing transversely through both sets of girders and cast-in-place diaphragms.

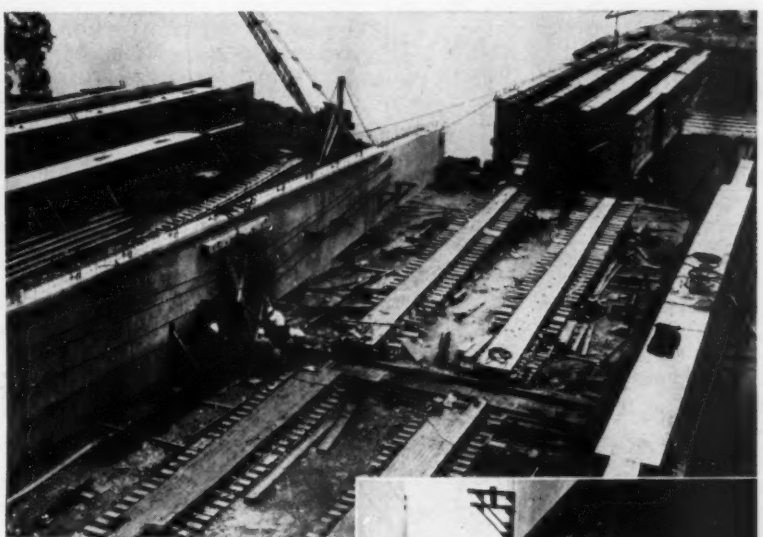
Post-tensioned concrete now spans 320′

Thirty-four concrete girders, poured and prestressed on the job site, now bridge Lake Oneida, New York, with maintenance-free concrete extending 460′ from abutment to abutment and spanning 320′ of open water.

Five sets of forms were assembled on three casting beds, two on the north approach and one on the south. The 24 cantilever girders were formed first. Truck mixers delivered the concrete to crane buckets which raised it to a series of tower hoppers. It was placed through elephant trunks into openings at 4′ intervals in the form and vibrated around the maze of tendons. After 5-day water curing, side forms were stripped and first stage stressing completed. Girders were rolled into place before second-stage stressing.

The 10 drop-in girders were stressed and grouted at the casting bed, then barged to the center of the bridge and raised into position. They were braced and diagonally tied so they could not move in relation to the cantilevers. Third-stage tensioning of cantilevers and casting and transverse stressing of the remaining counterweight and diaphragms completed the span work, ready for deck paving.

Concrete deliveries for this intricate job were handled by truck mixers of certified design, capacity, mixing speed and water control accuracy.



HIGH EARLY STRENGTH, 7¾ sack concrete, made it possible to cast a girder every 14½ days with each form. Interior girder (right) has 28 tendons, containing 24 or 28 ¼″ dia. wires. Exterior cantilevers (center) have 20 tendons; drop-in girders have 12. 9″ paper tubes in external girders reduced weight.

DROP-IN GIRDERS were barged into position between cantilevers and lifted by yokes. Contractor, Terry Contracting Corp., New York City; Post-tensioning steel, Joseph T. Ryerson & Son, Inc., Chicago; Consulting engineers, Summers, Munninger & Molke, Albany, N. Y.

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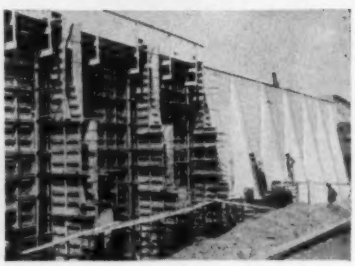

Typical of Simplex-Waco flexibility is this 32' battered wall with counterforts! Adaptability of forms permitted horizontal and vertical arrangements . . . use with Robertson Q. panels to produce an architectural finish. Simplex-Waco forms are easy to handle . . . quick to assemble . . . are self-aligning through special alignment slot. Simplex-Waco forms available on sales or rental/purchase plan.

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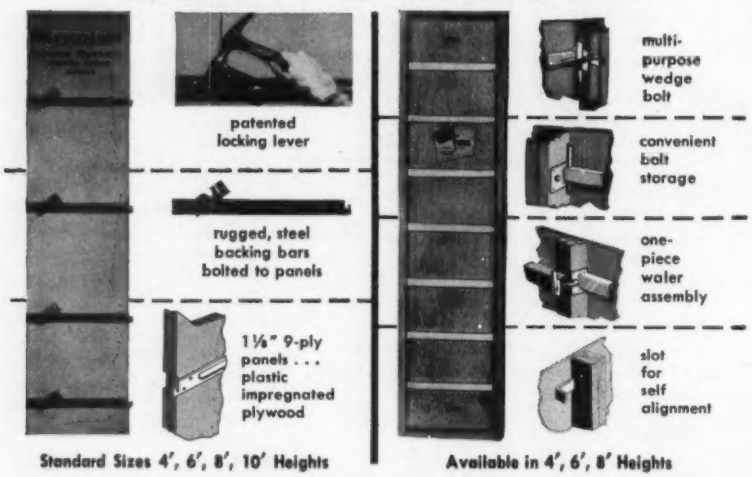
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the panel approaches the vertical, half the wall load rests on the hinge, and the results can be unfortunate. The general procedure is to roll the crane onto the floor slab and attach the rigging clevis to pickup insert eyebolts or brackets. The load is then applied steadily on the panel, observations for crack formation constantly made, and the forms stripped as the panel rises. The panel is then pulled into a vertical position, the crane moved in close, and the panel boomed out. The crane then travels to the setting position, where the panel is boomed out over the setting pad or footing and lowered. The braces—lightweight tubular braces with quick adjusting hardware work best—are attached. Finally, the panel is steadied at the vertical, plumbed, and securely braced to the floor slab.

Wall panels are usually joined to the floor slab by weld or cable clamps between dowels cast in the slab and panels. The space between floor and wall is then filled with rock dust, compacted, and the remaining portion of the floor placed and finished. Both wet and dry joinery for panels are practical with tilt-up construction. Wet joinery includes cast and untied columns. Dry joinery consists of welded or bolted joints. The details of wall to roof joinery will vary according to whether the roof material is wood, steel, or concrete, and whether there is a parapet.

Tilt-up incorporates all the valuable features of concrete construction, including attractiveness and variety of design, fire safety and low maintenance costs. While relatively new in this country, sufficient experience has accumulated to demonstrate its over-all economy and adaptability. Tilt-up has been particularly popular on the west coast, but builders in other parts of the country have begun to use it more frequently. Its position as an important method of concrete construction appears secure. END

ALPHA

BETTER CONSTRUCTION THROUGH
BETTER USE OF CEMENTS

news and notes from the field

THE HIGH COST OF MIXING WATER

Careful job-site control of mixing water is essential for getting the best results in all types of concrete construction. Too much mixing water is a danger recognized by most construction men, and unfortunately the real damage resulting from excess water often shows up too late to be remedied without extensive costs.

Examples of Delayed Damage From Too Much Mixing Water

1. Cracks in foundations—Foundation walls and floors crack excessively from high shrinkage and low tensile strength caused by excessive mixing water.

2. Freeze-thaw damage in pavements—Air is entrained in concrete to protect it from freezing and thawing damage. When the slump is greater than 5 inches, there is danger of the air content decreasing which reduces this important protection.

3. Sand streaks in foundations—excess water bleeds up the sides of forms, washing out the cement paste, and leaving a streaked, raw, unattractive wall surface.

4. Dusting floors—as concrete bleeds, water comes to the surface. If there is excessive bleeding, the water brings aggregate fines to the surface which often cause dusting and crazing.

5. Leaky walls and wet floors—Both can result from excessive voids in concrete caused by too much water.

The Water/Cash Ratio

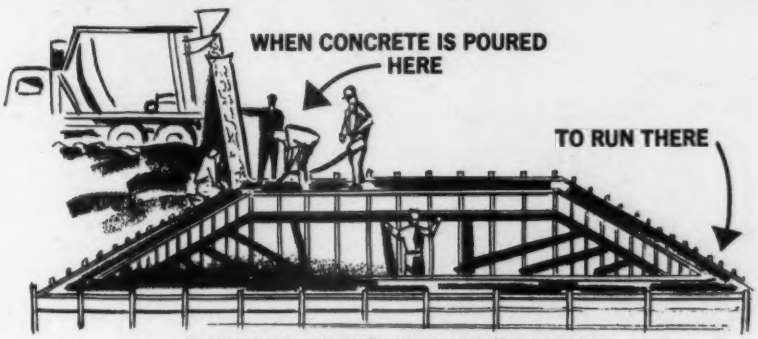
Much has been said and written on the subject of controlling the amount of mixing water, here it is expressed in terms everyone understands: money. To change a typical mix from a 2-inch slump to a 9-inch slump by adding water costs as much as $7.50 per 5-yard load if the strength is maintained. Here's why:

1-In. Gravel Mix, W/C = 6 Gal./Bg. (4000 psi)

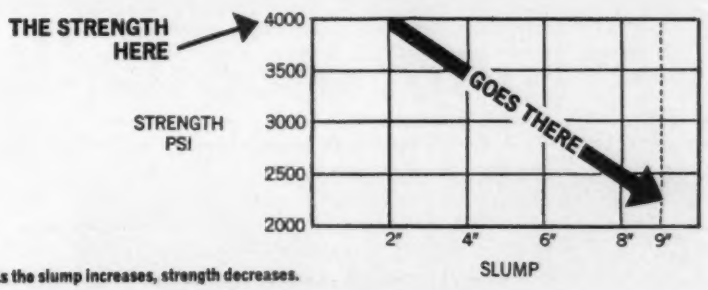
Total water used for 2-in. slump: 30 gal.
Total water used for 9-in. slump: 39 gal.
39 gal. − 30 gal. = 9 gal. excess water added

Required Cement for 6 Gal. W/C Ratio

2-in. slump, 30 ÷ 6 = 5 bags of cement needed
9-in. slump, 39 ÷ 6 = 6½ bags of cement needed



Do not add extra water to flow the concrete from one point to another. Wheel, shovel or chute it into place.



As the slump increases, strength decreases.

6½ bags − 5 bags = 1½ bags additional cement needed to maintain the 4000 psi strength

Extra Cost of 9-In. Slump Per Yd., 4000 psi Concrete

Extra cement costs
Approx. $1.50 per yard
In other words, the extra water costs
$7.50 per 5-yard load
or .....$ .17 per gallon
(figures are approximated)

The cost of mixing water should never be underestimated. Repairs to the structure and damage to the contractor's reputation can be far-reaching and costly . . . it's at this point where the water/cash ratio comes into being—is most easily recognized.

Concrete Has a Bright Future

Concrete is one of the most flexible and widely used of all construction materials. Based on recent advances and the growing trend in design and construction, concrete will continue to grow in favor among engineers, architects and customers. This is why Alpha is promoting these helpful tips on concreting as a continuing program to help improve concreting practices.

Reprints of this information are available free of charge. Contact your local Alpha Representative or write to Alpha's home office.

ALPHA
PORTLAND CEMENT COMPANY
Alpha Building, Easton, Pa.

FLEXURE TEST SPECIMENS

The four photographs on this page show the proper technique to use in making concrete flexure or beam test specimens using rigid and non-absorptive proprietary forms which are capable of meeting both ASTM and AASHO specifications.

Figure 1. The form shown provides a beam with a length at least 2 inches greater than 3 times the depth of the beam as tested. This minimum cross sectional dimension must be at least 3 times the maximum nominal size of the coarse aggregate used in making the test specimens, but in no case less than 6 by 6 inches.

Figure 2. The base plate is secured to the mold with built-in studs. The concrete in consolidated in two approximately equal layers by rodding at the rate of one stroke for each 2 square inches of area. The bottom layer is rodded for its full depth.

Figure 3. Here a mason's trowel is being used to spade the concrete along the sides and ends of the mold. Voids left by the tamping rods are also filled by tapping the sides of the mold.

Figure 4. When consolidation is complete, the concrete is struck off with a straightedge and the surface is finished with a wood or metal float. It is of the utmost importance to make the test specimen speedily and without interruption and to prevent evaporation of water until the specimen is removed from the mold. Until the specimen is demolded it should be kept continuously moist and at a temperature between 60 and 80 degrees F.

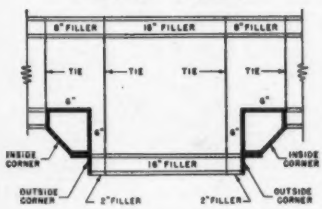
Photos courtesy Soiltest, Inc.

FILE: Testing

Symons all-purpose forms

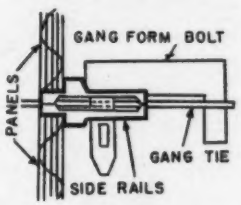
save time, labor and material

CUT-UP WALLS



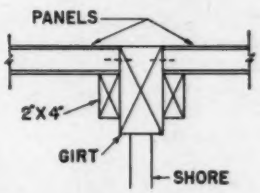
You can get what you need from Symons for cut-up wall construction. Our line includes standard panels, fillers, corners, special brackets, pilaster forms, brick ledges, corbels plus ties and other accessories.

GANG FORMING



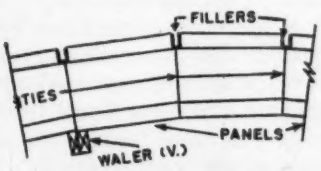
By using Symons steel-ply forms with the new gang form bolt, any size gang section can be made up without the use of fillers between each panel. You can break back ties before removing the gang section.

SLAB FORMING



When forming slabs with Symons steel-ply forms, the need for joists, and nailing usually required is eliminated. Panels are laid directly on top of the stringers. There are no plywood sheets to nail down.

CIRCULAR WALLS



Symons steel-ply forms and flexible steel fillers in 1", 1½" and 2" sizes are suitable for most any radius circular walls. Ties run directly through the slots in the center of the fillers. Minimum waling and bracing.

For complete information on Symons products, just write us. Ask also about our free engineering service . . . and rental-purchase options.

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Small-Size Pipe for Sanitary Lateral Sewers. *Published by Building Research Advisory Board, National Academy of Sciences—National Research Council, 2101 Constitution Avenue, Washington, D. C. $1.50.*

This revision of a report originally issued in 1957 makes recommendations regarding the minimum-size pipe to be allowed for use in street sanitary sewers in residential areas and the conditions which should be attached to the use of minimum-size pipe. Recommendations are also made for good design, construction, and maintenance practices relative to the use of small-size sanitary sewers.

Darex Diary

by Mel Prior

Member, American Concrete Institute
Technical Service Manager, Construction Chemicals

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(No. 23 of a series)

Trouble on Tap in Concrete Mixwater

MORE THAN ONCE, I've been asked to name the basic causes of concrete failure or distress. We all know that trouble can come from many sources, but the actual root of the evil is sometimes hard to pin down.

The one ingredient which probably stands out as the biggest troublemaker, because of misuse, is water. It has long been known that the water-cement ratio governs the strength and quality of concrete. However, do enough of us recognize that the nature of the water used can be a factor? Do we fully appreciate, also, that an excess of water above the amount required for the designed mix can bring disastrous results?

This country is using more and more detergents each year. Where do they go after use? Not uncommonly, they turn up in concrete mixing water. Unlike soaps, they are not filtered out during purification processes. Abnormally high air content in concrete with normal amounts of air entrainment specified will frequently result . . . without the mixwater being suspect because it came from a drinking tap. Investigate the water next time this happens to you.

Excessive use of mixing water is usually attributable to the men on the job. They tend to add water to any concrete mix indiscriminately in order that the concrete may be placed with minimum effort. If this reduces the strength, as we all know it will, then their answer is to add more cement.

Actually, at the present time, most concrete mixes are already overdesigned. More cement is being used than is required for a given strength because the designers are using old specifications based on 1,400 — 1,500 Wagner surface areas rather than on the present 1,800—2,000 Wagner surface areas of modern Type I cements. Not all, but a majority of specifiers are using outmoded references when setting up specs for concrete mixes. All specifications should be critically reviewed.

The ACI, PCA and ASTM are continually trying to bring to the attention of architects and engineers the changes that have taken place in cement in the past few decades. Portland cement is no different from any other "raw" material. It must be properly used—not abused, for maximum efficiency in modern concreting. The old "saw" that extra cement will cure all concrete ills does not hold up any more than the claim of some that a certain admixture is a panacea. We all know that there is no magic answer to the problem, but we can, at least recognize the pitfalls and take the indicated steps to avoid them.

For one thing, be sure of the water used on the job. Especially in metropolitan areas, detergents are definitely a factor to be considered. If necessary or advisable check with laboratory mixes using *distilled* water.

At the same time, consider the use of chemical admixtures such as WRDA water reducing agent or DARATARD retarding water reducer. These admixtures can help assure required plasticity, workability and strength with *minimum* content of both water and cement. We make no pretense that they are concrete cure-alls, but either one might very well be just what the doctor ordered for *your* next job.

Marinas: Recommendations for Design, Construction and Maintenance.

By Charles A. Chaney. Published by National Association of Engine and Boat Manufacturers, 420 Lexington Avenue, New York, N. Y. 247 pp. Illus. $7.50.

The public need for marinas increases as the sport of boating gains more popularity. The modern boatman requires services that can be provided only by a water front facility adequately planned for small craft. Contractors, engineers and architects will find in this book comprehensive information on all phases of the planning and construction of marinas. A minor portion of the text is devoted to preliminary studies and investigations, construction costs, rentals, maintenance and operation.

Various construction materials with their grades, species and classes are considered, and definite recommendations are made as to their quality, physical capacities and durability under varying conditions. In many cases typical design analyses or suggested formulae, equations and design procedures are given to assist the builder in specifying ample quantities and proper sizes of materials to satisfy safely, yet economically, the conditions expected in the field. Also there are suggestions as to the relative merits of many different types of structures and descriptions of numerous structural units which have rendered very good service in established marinas. All of these recommendations and suggestions, based upon the most sound current theories and practices, result in the development of well-founded standards upon which to base the planning of a modern and permanent type of marina.

Prestressed Concrete Simply Explained. *By H. Kaylor. Published by Contractor's Record Limited, London. Obtainable from Eastern News Distributors, 306 West 11th Street, New York, N. Y. 158 pp. Illus. $7.00.*

In the last few years building techniques and materials have increased in range and complexity, and new methods have been launched which are changing modern architecture. Among these the development of prestressed concrete has made a very important contribution toward better and more economic buildings. This book explains in lucid terms the principles, methods, development and design of prestressed concrete. The author has been closely associated with this development in both the original research work in England and it its practical application. For architects, engineers and students who wish to extend their knowledge of prestressed concrete, this book is an important guide.

Pile Foundations. *Second Edition. By Robert D. Chellis. Published by McGraw-Hill Book Company, 330 West 42nd Street, New York, N. Y. 683 pp. Illus. $16.00.*

Engineers, architects and contractors will find in this book much practical information on all phases of the theory, design, installation, maintenance and repair of pile foundations—along with numerous aids to overcome the variety of problems in pile design and driving.

The subjects of ship impact and wave forces on piled wharves and jetties have been greatly expanded and design charts have been added. Among the subjects covered are the principles of soil mechanics, methods of determining pile capacities from driving resistance, and the choice of piles and types of pile-driving equipment. The author describes and evaluates types of wood, concrete and steel piles and sheet piling, and gives methods for structural design of piles, prevention of corrosion of steel piles, protection of concrete piles, and load testing. He also discusses the causes, methods of prevention, and remedies for pile foundation failures and the developments in diesel hammers, prestressed concrete piles, and sand drainings.

Numerous line drawings and photographs illustrate the various pile and rig types, methods of placing, steps in repair, report forms, wharf and fender design, and many other subjects. The text has been completely updated to cover new developments.

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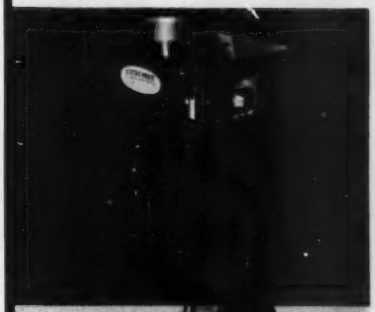

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copter concrete delivery

Palo Alto, Calif.—Faced with the task of erecting three 60-foot transmission towers in a mountain pass strewn with house-size boulders, a 1,700 pound helicopter was turned into a flying ready-mix concrete truck. As a result, all three towers were ready for line stringing in two days compared with original estimates of a week or two. Instead of trying to round up 20 or 30 strong laborers to back-pack dry aggregates and water in, the Hiller helicopter flew in foundation materials, concrete mix, and all the steel in eight and a half hours. The project was located at the 2,000-foot level of the bulldozer proof Santa Susanna Mountains in Southern California, marked the first time a light helicopter has been used to build steel powerline structures from the concrete foundation up. During the operation, the copter hauled in 18½ cubic yards of ready mixed concrete to pour the twelve foundations required for the three towers. The amount of concrete for each foundation varied depending on terrain but during one phase of the two-day airlift the Hiller delivered 12,000 pounds of concrete in one hour. Flights into the canyon were up to ¾ mile in length. Last step of the project was the delivery of all the steel for the 60-foot towers, which the Hiller airlifted in only 45 minutes.

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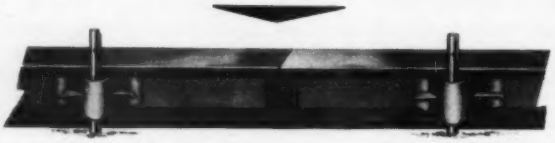

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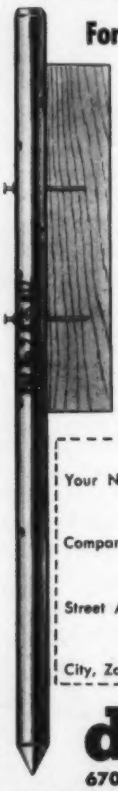

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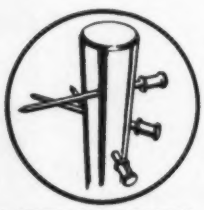

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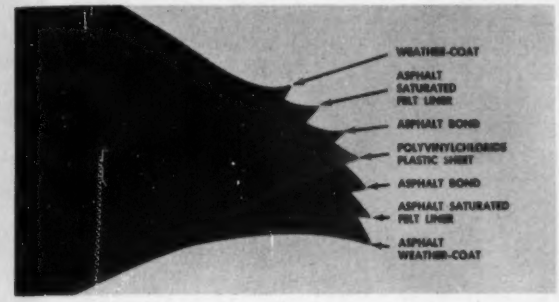
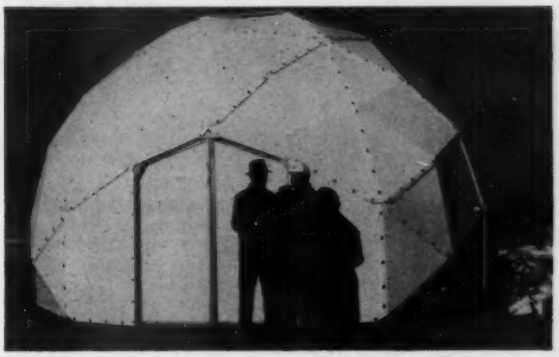


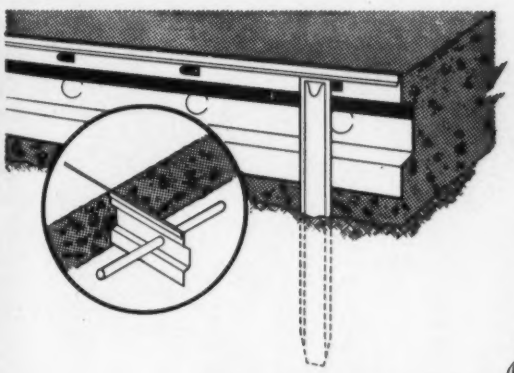
plastic liner

A mat-type liner which provides for the containment of water, brines, chemicals and sewage is manufactured in sheet form, and coated on the exterior with additional asphalt for maximum weather resistance. Liners are suitable for water reservoirs, chemical treatment ponds, sewage lagoons, for the general control of liquids and vapor, and for soil isolation of structures. W. R. Meadows, Inc., 26 Kimball Street, Elgin, Illinois.

dome shelter

A new lightweight structure is being used for job-site storage of tools and materials, as job construction "shacks" and as field offices. This portable dome is 12½ feet tall, weighs 450 pounds, 22 feet in diameter, is formed from prefabricated triangular panels and is weather resistant. No foundation or special site preparation is necessary since it bolts to a wooden base ring which is staked to the ground for permanence. Geospace Dome Shelters, 800 N. Lindbergh Blvd., St. Louis 66, Missouri.





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Stoop panel is tapered in two directions and held in place by removable clamps for easy stripping. Panel may be removed without enlarging the excavation. Removable clamps allow the slotted panel or adjacent panels to be removed independently of the stoop panel. Recommended for placing of residential porch supports, device is adaptable to most forming systems. Rocform Corp., 15160 W. Eight Mile Rd., Detroit, Mich.

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Designed especially for use by construction and mining engineers, supervisors, foremen and surveyors, a tiny, lightweight 9 transistor walkie-talkie has a maximum range of two miles on land, up to six miles on water, and operates for fifty hours on a standard nine-volt battery. Fulbright Co., 2 S. Florissant Rd., Ferguson, Mo.

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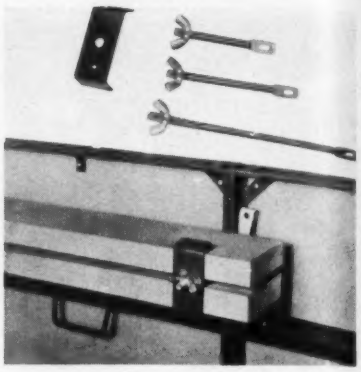
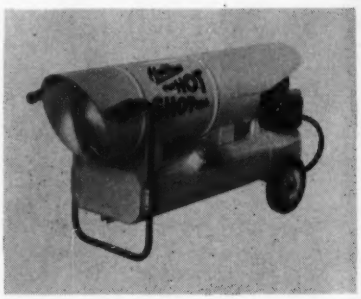
A transit for the contractor, architect and engineer is used in the precise construction of foundations, piers and walks; laying of drainage and sewerage lines; landscaping; building construction; and planning outdoor recreational facilities. The instrument features a telescope 8½ inches long. The telescope transits, swinging through a complete vertical circle. This feature increases the range of vertical angles, makes possible prolonging lines and simplifies checking adjustments. It is possible to read horizontal and vertical angles to five minutes by vernier. Request bulletin 285 from W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.



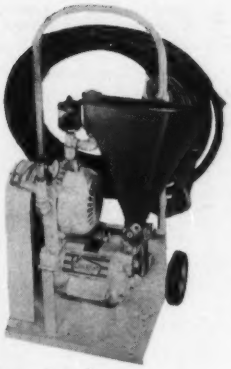
gang form accessories

Developed to increase forming speed and economy where repetitive forming is required, this gang form waler set consists of a waler rod, bracket and wing nut. The safe recommended load per lifting bracket is 2000 pounds, with approximate weight per square foot of gang section six pounds. Symons Clamp & Mfg. 4249 W. Diversey Ave., Chicago 39.



space heaters

Offered the contractor to help him prolong his productivity into cold weather, five models of space heaters range in size from 75,000 Btu/Hr. to 450,000 Btu/Hr. The portable heaters are clean, ventless and odorless, and are said to be particularly useful for work around walls, floors and scaffolds. Kelly Machine Div., 285 Chicago St., Buffalo, N. Y.

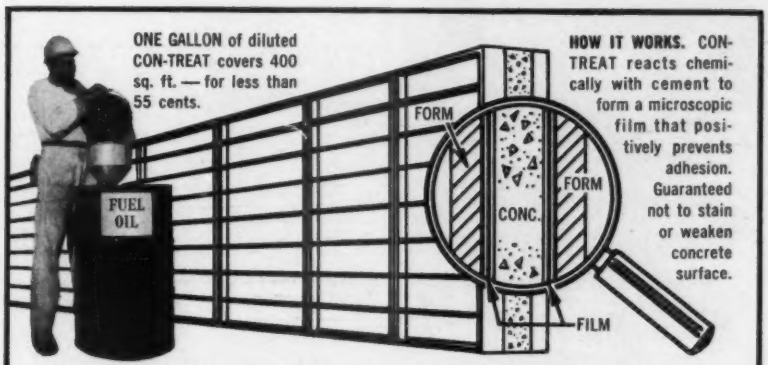


pattern pistol

This gun spray-applies dry wall textures, acoustic plasters, texture paints, metallic glitters, waterproofing and other materials with or without aggregate. The gun features a lightweight plastic hopper that will not dent or rust, and five orifices that are permanently attached to the gun. Goldblatt Tool Co., 1910 Walnut St., Kansas City, Mo.

electronic leak detector

Plumbing contractors, water works personnel and anyone concerned with underground piping will find use for this midget electronic leak detector. With an operating weight of 20 ounces, the midget detects all types of water leaks under concrete, dirt, wood and other surfaces with rapid, pin-point accuracy. Goldak Co., Inc., 1544 W. Glenoak Blvd., Glendale, Calif.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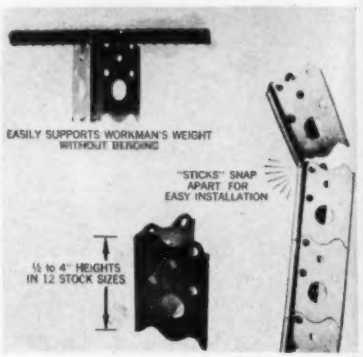
Among the uses of this material are positioning and setting of anchor bolts, fastening pipe flanges, hand rails, partitions, stanchions, conveyors, stadium seats and furnaces. It may also be used as a fast-setting grout for machinery bases, producing a hard base in a few hours. According to the manufacturer, it bonds readily to existing materials and withstands maximum impact, compression, tensile and sheer strengths, is odorless, vibration resistant, self-leveling and non-shrinking while setting. Monroe Co., 10703 Quebec Ave., Cleveland, Ohio.

builders' level

A 2-way level plumbs two surfaces at once, offering savings in time and labor for construction workers. It will a'so act as a facing straightedge when used in the leveling position. Available in standard 3-, 4-, and 6-foot lengths, other lengths may be obtained on special order. Lok Products Co., 1729 Hillside Drive, Glendale, Calif.

form release agent

A chemically active release agent for use on concrete forms of all types is said to prevent concrete from adhering to wood, fibre-board and steel forms and to be effective on mixers, trucks, scaffolding, wheelbarrows and other tools. One gallon will treat 400 square feet of surface. Edick Laboratories, Inc., 2358 S. Burrel St., Milwaukee, Wis.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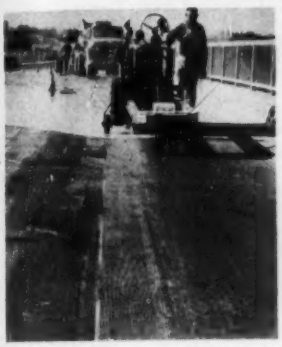
aluminum rebar chair

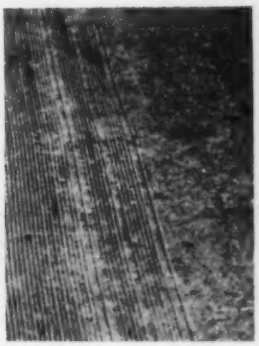
Featuring simplified non-tangling snap-apart construction, these aluminum chairs are used to support and center rebar and conduit in concrete forms. The aluminum construction prevents rust stains on finished concrete surfaces and supports weight of workmen without the chairs sagging or bending. Neptune Manufacturing Co., 3250 E. Olympic Blvd., Los Angeles 23, Calif.

plastic conduit

A speed-up in installation time was made possible by using high-impact styrene plastic conduit under new runways at the Cleveland Hopkins airport. Use of plastic conduit enabled joining lengths with quickly applied solvent weld, and the thirty-foot lengths required fewer joints than a heavier material. Carlon Products Corp., Cleveland, Ohio.

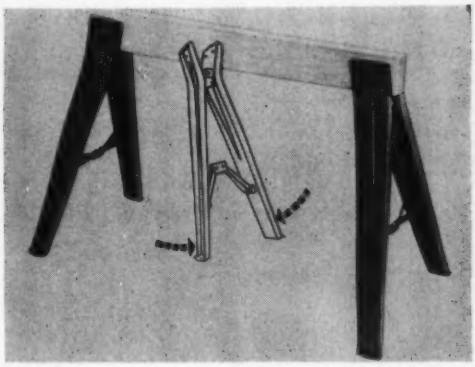
products





skid proofing slick pavement

When the curved deck of this bridge near Los Angeles became slick from an accumulation of tire rubber and oil, diamond saws were used to give it a skid-resistant surface. The diamond saws are spaced on the cutting head of the machine to cut shallow parallel grooves into the pavement. This method has been used to remove slick surfaces from concrete highways, bridge deckings, sidewalks, swimming pool deckings and industrial plant floors. Concut Sales, Inc., 1845 Belcroft Ave., El Monte, Calif.



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Self-locking saw horse legs, ideal for scaffolding for painters, plasterers and carpenters, as well as for barricades are available in 24-inch (horse) or 30-inch (barricade) heights. The legs will receive a two-by-four or a two-by-six of any length which locks into place by a clamping flange. Made of 14 gauge steel, the legs will support 1000 pounds. University Ave. Supply Co. West First and University, Des Moines.

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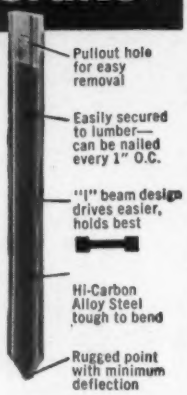
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literature

small business handbook

Single copies of a booklet "Profitable Management for Main Street" are available free. Based on the film "Small Business U. S. A.—The Story of Main Street," the booklet deals with a variety of business problems through selected case histories. All of the cases are based on fact, with many of the virtues and faults of small business management illustrated. The episodes are presented to demonstrate a point which may be helpful to a proprietor under similar circumstances. Dun & Bradstreet Inc., Public Relations Division, P. O. Box 803, Church St., Sta., New York 8, N. Y.

handling equipment

A condensed catalog of vibratory materials handling equipment, vibrating parts handling equipment, mechanical shaft seals, paper joggers, portable power tools and power rectification equipment has been published. The catalog contains over 200 illustrations, descriptions, data and specifications, and also includes listings of company representatives. Catalog 616, Syntron Co., 323 Lexington Ave., Homer City, Pa.

construction handbook

A handbook consisting of twelve separate bulletins of between four and twenty-four pages each, describes more than 400 products. Such products for concrete construction as form-tys, anchors, inserts, accessories and supports are described, and forming details and technical data given. The handbook also contains a cross index for products and types of construction. Richmond Screw Anchor Co., Inc., 816-838 Liberty Ave., Brooklyn 8, N. Y.

weatherproof field book

Of interest to engineers and surveyors, a two-color brochure describes a weather-proof field book. According to the manufacturer, the chemically-treated paper used in the field book and the brochure will never warp, wrinkle, soak up moisture, and is the only paper that can be written on while the surface is wet. Keuffel & Esser Co., 3rd and Adams Sts., Hoboken, N. J.

bucket catalog

General information on clamshell buckets, grabs and grapples is contained in this 50-page catalog. Included is data on how to choose the proper clamshell bucket and tables showing the relationship of buckets to weights of materials and sizes of cranes. Bulletin No. 2L-60, Erie Strayer Co., Rudolph Ave., Erie, Pa.

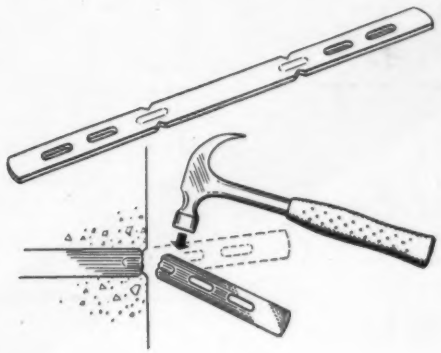
perlite data catalog

This catalog provides in detail specifications and data for uses of perlite aggregate for roof decks, floor fills, granular fill insulation and grade level slab floors. Also detailed is load test data and typical mix designs. Files 3-D-3 and 37-B-2, Perlite Institute, 45 W. 45th St., N. Y. 36.

vermiculite concrete

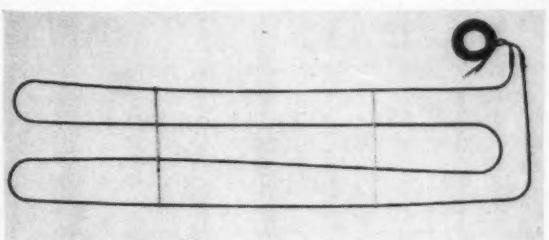
Specifications for vermiculite insulating concrete floors on grade, with or without radiant heating, have been issued. The folder covers mixing, placing, and curing of vermiculite concrete, as well as preparation of the base and the application of a sand concrete topping. Write Vermiculite Institute, 208 S. LaSalle St., Chicago 4, for AIA File No. 4-E-13.

products



dual-purpose ty

Adaptable for use with wood or steel-framed forms, this ty is a stripped, quality controlled steel bar that can be slipped into place from the outside of the forms. Twin slots are placed outside the break back, permitting the ty to be used in combination with wood and metal-framed forms opposite each other. Embossing centered on the break back notches helps secure the tys and form a solid bond. Simplex Industrial Forms, Inc., 5605 Industrial Ave., Rockford, Ill.



electric thawing cable

A new electric metal-sheathed defrosting element will save snow-shoveling throughout the winter season on the walks and driveways of schools, hospitals, hotels, and other commercial buildings. The heating cable can be imbedded in concrete, asphalt, macadam, or placed on present hard or gravel drives or walks and covered with a layer of surfacing material. These surfaces can be kept free of snow build-up by pressing a switch putting the cable in operation. Average operating cost is 15 cents an hour for clearing wheel tracks of a 50 foot driveway. Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsbourgh 8, Pennsylvania.

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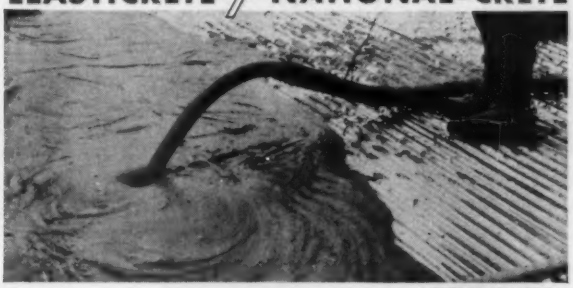

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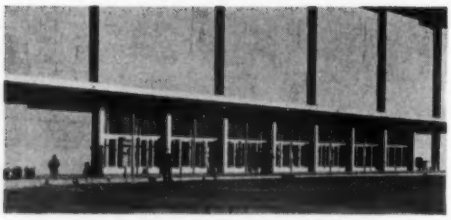

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literature

dam case studies

A 48-page publication features reports on twenty-five major dams built in the United States, Japan, Canada, Alaska and South America. Each hydraulic project described is illustrated with photographs, and the admixture's role in providing durability, strength and economy for this specialized construction is detailed. Bulletin MBR—P-3, The Master Builders Co., Cleveland 18, Ohio.

bridge-finishing machine

A bulletin describes the working versatility of the bridge-finishing machine and contains detailed specifications and a listing of optional equipment. The manufacturer reports that the machine can easily be converted into a standard highway finisher. Bulletin 61-159P, Chain Belt Co., Milwaukee 1, Wis.

tool catalog

A 48-page catalog describes a complete lineup of tools for contractors, road builders, tunnel builders, mines, quarries, railroads and factory maintenance. Diagrams detail tool features and there are complete specifications for each model shown. Catalog No. 46, Advertising Dept., Thor Power Tool Co., 175 N. State St., Aurora, Ill.

dampproofing-waterproofing

This guide to dampproofing and waterproofing techniques contains specifications and illustrations for the use of bituminous-based coatings above and below grade. It depicts the products required for each application, and illustrates their use. Write to Product News Section, Barrett Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y.

publication list

The American Society for Testing Materials has a 62-page list of publications. The list describes the symposiums, manuals, special publications, indexes, compilation of standards, charts, reference photographs and reports. The publications cover all phases of materials and their evaluations, and are arranged by titles and subject. The list may be obtained free from the Society at 1916 Race St., Philadelphia 3, Pa.

garment safety

Issued by the National Safety Council, this leaflet points out commonplace causes which lead to serious accidents in business and industry, and describes seven ways to reduce costly accidents due to defective work garments. Institute of Industrial Launderers, 1833 Jefferson Place, N. W., Washington, D. C.

integral color

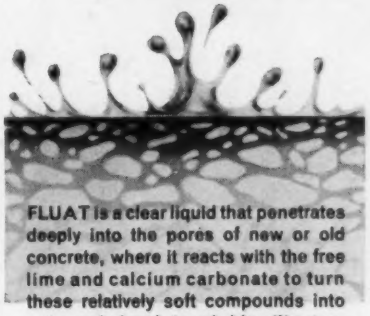
A four-page catalog covers the subject of integrally colored concrete floors that require color, hardness, abrasion resistance and ease of maintenance. Uses, methods of application, colors, detailed specifications and suggested after-treatments are described. A. C. Horn Co's., Division Sun Chemical Corp., 2133 85th St., North Bergen, N. J.

shoring

A bulletin describes adjustable horizontal shoring fabricated from high-strength structural aluminum alloy. Said to reduce erection, stripping and handling time, these beams are a combination I-beam and box section, and are adjustable to fit required spans. Hico Corp. of America, Aluminum Div., 120 Broadway, New York 5, N. Y.

the amazing liquid concrete hardener

FLUAT



FLUAT is a clear liquid that penetrates deeply into the pores of new or old concrete, where it reacts with the free lime and calcium carbonate to turn these relatively soft compounds into extremely hard, insoluble silicates. These silicates completely fill and seal the concrete pores, creating a very dense and hard surface which actually increase the overall strength of a concrete floor!

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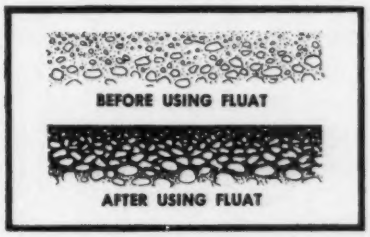

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